EXHIBIT 3

Pages 3-1 to 3-21
Expert Testimony Presented in
The Matter of the Application of
Port of Corpus Christi Authority of Nueces County
for TPDES Permit No. WQ0005253000

a) The Aransas Pass channel is the most important multi-species spawning site for the most economically valuable sportfishes in the region. 3-1.
b) The Aransas Pass channel is the primary conduit for larvae and early juvenile access from the Gulf of Mexico to their nursery areas in Texas' Coastal Bend region. 3-3.
    a. Larvae rely on tidal currents to bring them into the estuaries which serve as a nursery and feeding grounds until they mature into juveniles and adults and migrate back out into the Gulf. 3-4.
c) TCEQ did not consider the site-specific characteristics of the marine ecology within the Aransas Pass channel, the Bay and surrounding estuaries, and the Gulf. 3-5.
d) The desalination effluent will have a salinity as high as 58.5 ppt. 3-6.
    a. The natural salinity within the shipping channel already exceeds the predicted no-effect concentration for portions of the year, and as such any additional increase in salinity would jeopardize aquatic life. 3-6.
e) Early life stage animals tend to be the most sensitive to environmental perturbation, including salinity fluctuations. 3-6 to 3-7.
    a. Increased salinity can be extremely harmful to larvae and embryos. 3-7 to 3-14.
f) The toxicity testing required in the draft permit is not capable of measuring acute salinity toxicity, which is the most important risk factor of the discharge. 3-15.
g) The discharge has the potential to be extremely destructive to the ecology in the region, significantly reducing fish populations in the entire region. 3-16.
    a. Disturbances in this area could result in negative impact on the size and productivity of the regional fish populations, which in turn would increase the risk of overfishing and collapsing these fish populations. 3-17.
    b. Fish cannot go elsewhere to spawn; they have evolved to spawn and migrate through this area. 3-18. Changes in salinity levels can cause false spawning cues. 3-19.
    c. The draft permit, if issued, will present a significant threat to fisheries and commercial fishing in Corpus Christi and the ship channel. 3-19 to 3-20.

MARINE ENVIRONMENT, AQUATIC LIFE, AND WILDLIFE, INCLUDING FISH AND INVERTEBRATE GROWTH AND SURVIVAL ACROSS A VARIETY OF LIFE STAGES?

A. The disturbance that will be caused by the effluent discharge has the potential to be extremely destructive to the ecology in the region. I am particularly concerned because of the valuable nature of the Aransas Pass Tidal Inlet as critical spawning habitat (a type of essential fish habitat) for ecologically and economically important marine fishes. I think it is necessary and important to understand that first.

Q. PLEASE EXPLAIN THAT.

A. From the perspective of fish ecology, ecosystem health, and fisheries, the location chosen by the Port of Corpus Christi for the discharge is literally the worst possible location. It is the nexus point for all the critical processes associated with fish populations (migrations, feeding, larval dispersal, spawning) that interconnect the bay systems and the open Gulf.

Q. WHY IS THIS AREA SO ECOLOGICALLY IMPORTANT?

A. The Aransas Pass tidal inlet is the most important multi-species, spawning site for the most economically valuable sportfishes in the region, which include red drum (*Sciaenops ocellatus*), spotted seatrout (*Cynoscion nebulosus*), sheepshead (*Archosargus probatocephalus*), and black drum (*Pogonias cromis*). In addition, the tidal inlet is the only migratory pathway for the offshore and inshore spawning migration of the local population of southern flounder (*Paralichthys lethostigma*), which is an important recreational and commercial species. New and preliminary research indicates that flounder may be using the channel and the surrounding area around it as their main spawning grounds. Each of these fish species forms spawning aggregations, which are predictable large gatherings of fish at specific times and locations solely for the purposes of spawning. Moreover, the Aransas Pass inlet holds the largest and most productive

spawning aggregations for these species in the entire region (i.e. more than 50 miles to the north or south of the inlet). Collectively, this site houses large spawning aggregations of different species at different times of the year (e.g. flounder and sheepshead in winter and spring; seatrout in spring and summer; red drum in the fall). Therefore, the productivity and resilience of local populations of these sportfishes and the fisheries they support are directly linked to, and dependent upon, the reproductive activity that occurs at this inlet. The proposed draft permit has the significant potential to threaten these fish populations and their fisheries in critical ways.

Q. HOW DOES THE PROPOSED EFFLUENT DISCHARGE PRESENT A RISK OF HARM TO THIS AQUATIC LIFE?

A. Disturbances to this area—such as increased salinity, reduced oxygen levels, turbidity, noise, habitat alteration, and other stressors have the potential to reduce spawning activity and the reproductive output of these fishes. Given the disproportional number of fish that spawn in the inlet compared to adjacent areas and the fact that it is the only site for a large expanse of coastline that connects the Gulf to the bays, disturbances in this area could result in a direct measurable, negative impact on the size and productivity of the regional populations of these fishes. In turn, such a scenario would directly harm local fisheries by reducing the number of fish in the region that are available to be harvested, which would increase the risk of overfishing and collapsing these fish populations under current levels of fishing practices. Certain species and fisheries (e.g. southern flounder) have recently been identified as being in serious trouble and, thus, the protection of their spawning habitat is absolutely critical for recovery and sustainability.

Q. HAVE YOU DIRECTLY RESEARCHED THESE ISSUES?

A. Yes.

that occur in the area, and the inlet facilitates this key characteristic of their life history and persistence of their populations. The Aransas Pass tidal inlet and surrounding bays are the most critical environmental features in the region in terms of supporting healthy fish and crustacean populations. For these reasons, this area has been designated as "*Essential Fish Habitat,*" as defined by the Magnuson-Stevens Fishery Conservation and Management Act. Altering the water chemistry and flow through these areas will negatively impact fish and other marine species that depend on access through these inlets for survival, reproduction, persistence, and growth to maturity. This channel has been artificially deepened to allow for ship traffic. An unintended consequence of deepening and increasing the water flow through the inlet was a reduction in the ability of other nearby inlets to remain open, causing them to close due to sedimentation resulting in loss of access to nursery habitats for marine animals. As a result, the Aransas Pass channel is now the primary conduit for larvae and early juvenile access from the Gulf of Mexico to their nursery areas in Texas' Coastal Bend region. The nearest major tidal inlets are approximately 60 miles to the North and 80 miles to the South. Thus, the Aransas Inlet is the only significant source of ingress for marine life to access the estuaries of the Coastal Bend Region (e.g., Aransas Bay, Corpus Christi Bay, and the Upper Laguna Madre). Impairment in this areas would have wide geographical implications.

Q. WHAT IS THE BAY-GULF EXCHANGE?

A. For many species, the Bay-Gulf exchange is a requirement for their estuarine (bay)-dependent life history strategy. For example, the adult live in the Gulf of Mexico, and their young are dependent upon estuaries nurseries for completion of their life cycle. Inlets, and in particular Harbor Island at the Aransas Pass serves as a conduit for the movement for various life stages of numerous species of marine life affording the critical Bay-Gulf

exchange. Adults live in the Gulf of Mexico, and seasonally aggregate in and near the Aransas Pass tidal inlet to spawn. Those eggs hatch near the Aransas Pass tidal inlet as a very sensitive larvae and early life stages. The spawning occurs near the tidal inlets, so that these early life phases have a high probably to enter the bay/estuary and delivered to their nursery ground (typically seagrasses, marshes, mud bottom, and oyster reef, etc.) Typically, marine species, have the ability to detect and orient themselves towards less saline water and other chemical cues (i.e., within the Corpus Christi Bay estuary as compared to the Gulf). Yet, they are unable to swim against a current they are considered planktonic, and rely on tidal currents to bring them into the estuaries which serve as nursery and feeding grounds until they mature into juveniles and eventually adults. Upon sexual maturity, the general pattern for most species is to migrate back out into the Gulf to join the spawning stocks, and repeat this estuarine dependent life-cycle strategy. Some exceptions include 'estuarine resident' species remain their entire lives in the estuary, and some species move in and out of the estuary on seasonal basis through the tidal inlet (or in the inlet itself) to the adjacent Gulf and return to the estuary over the course of the spawning season.

Q. DOES THE EXAMPLE YOU JUST GAVE APPLY TO ALL AQUATIC SPECIES IN THE AREA?

A. No, not necessarily. That example applies to the majority estuarine species of finfish and crustaceans, but each species may have slightly unique characteristics regarding the timing, location, and duration in each stage of its life cycle, along with residency time in the estuary and unique migration patterns. For example, some species, the adults, may actually migrate through the tidal inlet to spawn within the Corpus Christi Bay. Nevertheless, the exchange between the bay and gulf through the tidal inlet is an essential factor providing connectivity

III. SUMMARY OF OPINIONS

Q. HAVE YOU DEVELOPED ANY OPINIONS REGARDING THE APPLICATION FILED BY THE PORT OF CORPUS CHRISTI OR THE DRAFT PERMIT PREPARED BY TCEQ?

A. Yes.

Q. WHAT IS YOUR OPINION REGARDING THE IMPACT OF THE BRINE DISCHARGE FROM THE POCCA DESALINATION PLANT ON THE MARINE ECOLOGY OF CORPUS CHRISTI BAY AND SURROUNDING WATERS?

A. 1) The draft permit, if issued, would authorize the discharge of brine into the Aransas Pass tidal inlet, which will have substantial adverse impacts on marine life within Corpus Christi Bay, neighboring bay systems, and the Gulf of Mexico. Specifically, the discharge of brine, in these volumes, into the Aransas pas tidal inlet will result in an significant increase in the mortality of larvae as they enter Aransas pass on the journey to the nursery grounds in Corpus Christi bay and surrounding estuary systems.

2) The additional mortality of larvae of numerous species resulting from the brine discharge has the potential to result in wide-ranging effects on the local marine/estuarine ecosystem. Those impacts could range from catastrophic to negligible. While catastrophic impacts are unlikely, so too are negligible impacts. We do not have sufficient information to predict just where in that continuum the effect would fall. However, there is sufficient evidence for concern about brine discharge at this location.

3) In evaluating the potential impacts on the marine environment, TCEQ did not consider the site-specific characteristics of the marine ecology within the Aransas pass tidal inlet, Corpus Christi Bay and surrounding estuaries, and the Gulf of Mexico. The TCEQ did not properly consider actual hydrodynamic conditions in the receiving waters nor did they properly consider the reproductive, migration, and life development patterns of fish and crustacean species that utilize this area.

A. The draft permit uses intake salinity values that range from 18 to 22 per thousand (ppt). The intake for the desalination plant has been moved offshore, and this will impact the intake salinity significantly. The salinity further out, in the Gulf of Mexico, is much higher than in the inner estuary. Thus, the salinity of the intake water will be higher than modeled by the Port of Corpus Christi and the TCEQ. Instead of the 18 to 22 ppt utilized in the draft permit, the expected intake salinity from the currently proposed location will be in the range of 32 to 35 ppt.

Q. WHAT IS THE IMPACT OF A HIGHER INTAKE SALINITY THAN INDICATED IN THE DRAFT PERMIT?

A. The draft permit provides for a 40% recovery. With an input salinity of 35 ppt, this would result in the desalination effluent having a salinity as high as 58.5 ppt. This number is derived from an intake salinity of 35 ppt multiplied by 1.67, which is the concentration factor associated with a 40% recovery operation. A salinity this high in the effluent would be very harmful to aquatic life. The available literature allows for the determination of a predicted no-effect concentration for salinity of 37.4 ppt, based on 8 acute lethality data sets across 7 species. The natural salinity within the shipping channel already exceeds the predicted no-effect concentration for portions of the year, and as such any additional increase in salinity would jeopardize aquatic life. Given the mixing model uncertainty, the high sensitivity of local species, and the naturally high salinities already found in the shipping channel, it is impossible to suggest that this permit will be protective of aquatic species.

Q. WHY DO YOU CONTEND THE DRAFT PERMIT FAILS TO PROPERLY ACCOUNT FOR THE AMBIENT, OR BACKGROUND, SALINITY IN THE CHANNEL?

A. The draft permit uses a background salinity of 31.8 ppt. I examined a 5-year data set for salinity in the shipping channel available from the Mission Aransas National Estuarine

Research Reserve spanning 2007 to 2012. The median salinity value in this data set was 32.5 ppt, which by definition means that half of the data points in the data set exceeded 32.5 ppt under natural conditions. To be protective of aquatic life that is hypersensitive to salinity, it is not enough to use an ambient background salinity that is too low at least half of the time. This will result in salinity levels after discharge frequently being higher than predicted, which will be harmful to aquatic life.

Q. HOW DO THESE CONSIDERATIONS INFLUENCE THE IMPACT UPON AQUATIC LIFE?

A. It is important to understand that the channel acts as the main conduit between the Gulf of Mexico and the inner estuary. Many species spawn in the coastal ocean near the mouth of the channel, and the sensitive early life stages then move through the channel and settle within the estuary, which is used as a nursery ground. These species include recreationally and commercially important species, such as red drum, black drum and southern flounder. Early life stage animals tend to be the most sensitive to environmental perturbation, including salinity fluctuations. Accordingly, high salinity can result in high mortality and slower growth in larva. These impacts would likely significantly decrease aquatic life productivity in the area.

Q. YOU ALSO HAVE STATED THAT YOU BELIEVE THAT THE DRAFT PERMIT, IF ISSUED, WILL PRESENT A SIGNIFICANT THREAT TO COMMERCIAL FISHING AND FISHERIES IN CORPUS CHRISTI BAY AND THE SHIP CHANNEL. WHY DO YOU BELIEVE THIS?

A. As I have noted, increased salinity can be extremely harmful to aquatic life larva and embryos. Increased morbidity of larva and embryos is potentially likely from the increased salinity caused by the effluent discharge to be allowed under the permit would be expected to result in a significant decrease in fish populations in the waters in the area.

animal. Water inherently moves to higher concentrations of salt. So that means that the water that's inside of a fish is going to move outside of the fish, effectively dehydrating it.

09:52 Now, as I pointed out just a moment ago, this kind of the speed at which this occurs is impacted by something called the surface area to volume ratio. The smaller an animal is, the higher the surface area is to the volume that's inside of its body. That means it's 09:52 going to lose all of its water much, much more quickly. That's, you know, pretty much an accepted truth when it comes to osmoregulatory physiology.

So when you're looking at the impacts on larval fish, it's all about the water getting sucked out 09:52 of the animal and the animal not having enough time or ability to counteract it by drinking water, processing that water, and then excreting salt.

MS. FULTON: Okay. I -- if I'm reading everybody's handwriting correctly, I think that's all 09:53 I've got.

JUDGE SMITH: Thank you, Ms. Fulton.

Mr. Moorhead, do you have questions for Dr. Esbaugh?

MR. MOORHEAD: No questions, your Honor.

09:53 **JUDGE SMITH:** Okay. So from the ED?

for migration and spawning success by providing access to their nursery and spawning grounds and movement of their early life phases.

Q. CAN YOU EXPLAIN HOW THE LOCATION OF THE PROPOSED BRINE DISCHARGE WITHIN THE ARANSAS PASS TIDAL INLET COULD AFFECT THE MARINE ENVIRONMENT?

A. The physical oceanographic and ecological dynamics in inlets result in a concentration of marine life. As I previously explained, many species use the tidal inlets as an exchange between the Gulf and bay environments for various stages of their life cycle. Because Harbor Island is located at the only major tidal inlet in the region (the nearest major tidal inlets are approximately 60 miles north and 80 miles south), large concentrations of aquatic species congregate at the Aransas Pass tidal inlet as their only access point, including an extraordinarily high concentration of larval finfish and crustaceans. During the larval stage, these marine animals are extremely sensitive and intolerant of any sudden changes to ambient water conditions, especially salinity. Small changes in ambient water attributes can cause high mortality. Furthermore, these small individuals effectively lack the ability to maneuver and are almost entirely dependent on tidal currents for transportation. As such, they lack the ability to avoid the plume of brine discharge that can have lethal salinity levels.

Q. I'D LIKE YOU TO LOOK AT THE DOCUMENT MARKED EXHIBIT PAC-8.

A. Ok.

Q. DO YOU RECOGNIZE THIS DOCUMENT?

A. Yes. This is the Executive Director's Response to Comments.

Q. DID YOU REVIEW THIS DOCUMENT IN FORMING YOU EXPERT OPINION?

A. I did.

PAC offers Exhibit PAC-8.

Q. HOW DID THIS DOCUMENT HELP FORM YOUR OPINION?

A. It confirmed to me that the Executive Director did not evaluate the location of the discharge in coming to the conclusion that the proposed discharge would not adversely affect the marine environment. As noted on page 62 of the Response to Comments, "The permit is developed such that acute and chronic toxic criteria apply at the edge of their respective regulatory mixing zone boundaries." Unfortunately, the mixing zone boundaries occupy a substantial portion of the Aransas Pass tidal inlet, and larvae do not have the ability to travel around the edge of the mixing zone. Billions of larvae must travel through the mixing zones, for which no toxic criteria apply. Quite to the contrary of the Executive Director's position, it is my opinion that this discharge will have significant adverse effects on the marine environment.

Q. YOU'VE INDICATED THAT AQUATIC LARVAE ARE SENSITIVE TO CHANGES IN SALINITY LEVELS. BUT DOESN'T THE SALINITY LEVEL IN CORPUS CHRISTI BAY CHANGE VARY NATURALLY?

A. Yes, it does; often dropping quite drastically toward the lower salinities. Aquatic species, and especially adults can adjust and avoid changes in salinity levels, and are also capable of surviving and occurring over a range of salinity levels. However, those salinity levels naturally change gradually over much longer times steps: days, weeks, and months. Immediately after a major rain event, freshwater inflows into a bay will increase, resulting in reduced salinity levels. The larvae and other early life history phases are much more sensitive to abrupt salinity changes, and lack the ability to avoid area that may cause mortality (i.e., they are planktonic and cannot swim against a current). When a bay has abnormally low salinity, this is referred to as a hyposaline condition. On the other hand, during drought conditions, freshwater inflows are reduced and salinity conditions within the bay increase. When a bay has abnormally high salinity, it is called a hypersaline condition.

Q. IF AQUATIC SPECIES CAN SURVIVE WITHIN A RANGE OF SALINITY LEVELS, WHY DOES THE BRINE DISCHARGE FROM THE POCCA DESALINATION PLANT CAUSE YOU CONCERN?

A. Because the brine from the desalination plant will be discharged into a narrow tidal inlet, where marine life is heavily concentration compared to other regions of the bay/Gulf. It is primary a location issue. Thus, in these narrow inlet with high concentration of larvae, the outflow would effectively create a wall of hypersaline water that the larvae must pass through in order to enter the bay and reach their nursery grounds. Since larvae have little, if any, ability to maneuver and are dependent on tidal currents to enter the bay, they have no ability to avoid the plume. When the larvae are pushed by tidal current through Aransas Pass and into the brine discharge plume, they are instantaneously going from an ambient salinity level at the mouth of the tidal inlet into a hypersaline condition within the brine discharge plume. Moreover, the tide also ebbs and flows potentially creating multiple opportunities for exposures. As an analogy, if a human being is transported directly from sea level to the top of Mt. Everest, the change in altitude and lack of oxygen would likely cause mortality. Similarly, abruptly changing from normal saline conditions to hypersaline conditions will have drastic negative effects on aquatic species, and especially for early life phases. At minimum, these marine animals would be impaired and suffer from non-lethal (indirect) effects that eventually cause subsequent mortality. Furthermore, larvae are much more sensitive to such changes than adults are and have a much greater probability of mortality. Even with conservative calculations, the elevated salinity has the potential to result in mortality for literally millions of larvae and nekton during peak recruitment season.

Q. WHAT IS THE RECRUITMENT SEASON?

A: Joseph Trungale, Gregory Stunz, Brad Erisman, Bruce Wiland, and Andrew Esbaugh.

Q. HAVE YOU RELIED ON THE OPINIONS, DATA, OR INFORMATION FROM THOSE OTHER TESTIFYING WITNESSES RETAINED BY PAC AND OFFERED AS EXPERTS IN FORMING YOUR OPINIONS?

A. I reviewed their opinions and conclusions and find them to be consistent with my opinions, but I did not rely on them in forming my own opinion.

IV. IMPACT OF BRINE DISCHARGE ON THE MARINE ENVIRONMENT, AQUATIC LIFE, AND WILDLIFE

Q. WHY DO YOU CONTEND THAT THE DRAFT PERMIT, IF ISSUED, WILL HAVE SIGNIFICANT ADVERSE IMPACTS ON MARINE LIFE WITHIN CORPUS CHRISTI BAY, NEIGHBORING BAY SYSTEMS, AND THE GULF OF MEXICO?

A. The proposed location of the brine discharge is in an area of high biological productivity and of great importance for the immigration of larval stages of marine organisms on their way to critical nursery areas within the estuary. While estuarine organisms are generally tolerant of a range of salinities and temperatures, larval stages are not particularly tolerant. This is especially true where the individual organisms encounter a sharp or sudden change in conditions such as might be expected in a brine discharge zone.

Q. CAN YOU EXPLAIN WHAT YOU MEAN BY THE IMMIGRATION OF MARINE ORGANISMS ON THEIR WAY TO CRITICAL NURSERY AREAS WITHIN THE ESTUARY?

A. Many coastal species around the world have a life-history strategy often called "Estuarine Dependent Marine Species." These species include both fish and shellfish (i.e. shrimp and crabs). While details differ among species, the process goes something like this: the adults mostly live permanently in offshore, typically coastal, ocean waters; they spawn in these offshore waters and the eggs and early larvae drift for days or weeks in coastal currents; the larvae eventually arrive at the coast and many are ultimately drawn into tidal inlets that connect the ocean with the estuary. Some of those larvae drawn into the inlet on the flood tide are carried into the estuary to suitable habitat where they remain to develop into

juveniles and sub-adults. This development into the sub-adult stage takes one or more years before they return to the ocean as maturing adults.

Q. WHY DO THESE SPECIES SPAWN OFFSHORE AND THE JUVENILES UTILIZE THE ESTUARY AS NURSERY HABITAT?

A. A primary reason this behavior has developed is that the larval stages are relatively sensitive to both absolute salinities and temperatures and especially to changes in temperature and salinity.

Q. CAN YOU EXPLAIN WHY THE LARVAE DO NOT POSSESS THE ABILITY TO MOVE AWAY FROM UNDESIRABLE CONDITIONS?

A. Sure. I'll use the Red drum as an example. Red drum spawn in open water, almost entirely in the ocean outside the tidal inlets. The eggs and sperm are released into the water column by females and males where fertilization occurs. The eggs are slightly buoyant at the spawning salinities and float in the water until hatching, which typically occurs within 24 hours. Red drum eggs are around 1 mm in diameter. The embryos that emerge from the egg are essentially a large yolk sac with a little tail attached. They have no open eyes, no mouth, and only a fin-fold along the "spine" or notochord. It might remind one of a tiny, undeveloped tadpole. Yolk-sac larvae are about 2.5 mm in length.

Q. DO THEY HAVE THE ABILITY TO SWIM?

A. At this point, no.

Q. WHEN DO THEY DEVELOP THE ABILITY TO SWIM AND NAVIGATE UNDESIRABLE CONDITIONS SUCH AS INCREASED SALINITY?

A. It will be a while before that occurs. Over the next 8-10 days the larvae slowly develop eyes, a mouth, a gut, and the rudiments of fins. They begin feeding at about day three. At 10 days post hatch ("dph"), a red drum larva might be 5-6 mm in length. At 20 dph, a larva would be roughly 10 mm in length and will have developed a full complement of fins, but it will still not have scales. Up until this stage the larva is planktonic, meaning they are

Q. SO IN ORDER TO SURVIVE THESE LARVAE MUST BE TRANSPORTED FROM THE GULF INTO THE ESTUARY NURSERY GROUNDS?

A. Yes.

Q. HOW DOES THE DISCHARGE FROM THE PROPOSED DESALINATION PLANT AFFECT THESE LARVAE?

A. As previously, described, these larvae are dependent on tidal currents to be transported from the Gulf into their nursery habitats within Corpus Christi Bay and surrounding estuaries. In order to reach those nursery habitats, the larvae must pass through Aransas Pass, there is no other way for them to reach their nursery habitats. The proposed discharge would be located directly in the path of these larvae on their journey to their nursery habitats. The aquatic life mixing zone is 92.4 meters wide, and 126.4 meters long. Aransas Pass tidal inlet from Harbor Island to Port Aransas is only about 385 meters across and the mixing zone is right in the middle of this passage way. The discharge from the desalination plant will contain concentrated brine of much greater salinity than the naturally occurring ambient conditions, which the larvae will not be able to avoid.

Q. HOW DOES INCREASED SALINITY AFFECT THESE LARVAE?

A. While estuarine organisms are generally tolerant of a range of salinities and temperatures, larval stages are not particularly tolerant. This is especially true where the individual organisms encounter a sharp or sudden change in conditions. Fish have the ability to regulate ionic concentrations in their bodies relative to the concentration in the environment by combinations of drinking water, urine excretion, and exchanges across chloride cells on the gills and other body tissues. The larval stages of that fish, however, have not developed many, if any of these capabilities, and thus, they cannot cope with substantial changes in external salinities. Basically, high salinity sucks the water out of them.

understandably very confusing. Not even confusing. It causes problems with the regulation, in that salt is not a toxin in the estuary. There's plenty of it everywhere. The issue here is the very high
09:20 concentration of that in a small place.

And so the testing that's -- that's being required after the plant is built should test, in my opinion, the primary thing they should be testing is acute salinity toxicity. And I guess my question, I --
09:21 is is that really happening in these tests? I've asked a number of people. I've heard a lot of conversation. And it appears that it's at least possible the way the tests are being run, that if things die from acute salinity, that sort of negates the test, when, in my
09:21 mind, the acute salinity is the thing that needs to be tested. So I guess what I would need is some assurance from somebody that really knows how these tests are going to be run and what's going to happen.

These organisms die from salinity stress,
09:21 they're dead. That proves that it's killing them. And, I mean, this is being done with some standard fish that are used in laboratory testing, menidia and mycids. There are protocols for I know in EPA for testing larval stages. I don't see that that's in here. Since larvae
09:22 are the thing that are critical, I would think that that

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A. The disturbance that will be caused by the effluent discharge has the potential to be extremely destructive to the ecology in the region. I am particularly concerned because of the valuable nature of the Aransas Pass Tidal Inlet as critical spawning habitat (a type of essential fish habitat) for ecologically and economically important marine fishes. I think it is necessary and important to understand that first.

Q. PLEASE EXPLAIN THAT.

A. From the perspective of fish ecology, ecosystem health, and fisheries, the location chosen by the Port of Corpus Christi for the discharge is literally the worst possible location. It is the nexus point for all the critical processes associated with fish populations (migrations, feeding, larval dispersal, spawning) that interconnect the bay systems and the open Gulf.

Q. WHY IS THIS AREA SO ECOLOGICALLY IMPORTANT?

A. The Aransas Pass tidal inlet is the most important multi-species, spawning site for the most economically valuable sportfishes in the region, which include red drum (*Sciaenops ocellatus*), spotted seatrout (*Cynoscion nebulosus*), sheepshead (*Archosargus probatocephalus*), and black drum (*Pogonias cromis*). In addition, the tidal inlet is the only migratory pathway for the offshore and inshore spawning migration of the local population of southern flounder (*Paralichthys lethostigma*), which is an important recreational and commercial species. New and preliminary research indicates that flounder may be using the channel and the surrounding area around it as their main spawning grounds. Each of these fish species forms spawning aggregations, which are predictable large gatherings of fish at specific times and locations solely for the purposes of spawning. Moreover, the Aransas Pass inlet holds the largest and most productive

spawning aggregations for these species in the entire region (i.e. more than 50 miles to the north or south of the inlet). Collectively, this site houses large spawning aggregations of different species at different times of the year (e.g. flounder and sheepshead in winter and spring; seatrout in spring and summer; red drum in the fall). Therefore, the productivity and resilience of local populations of these sportfishes and the fisheries they support are directly linked to, and dependent upon, the reproductive activity that occurs at this inlet. The proposed draft permit has the significant potential to threaten these fish populations and their fisheries in critical ways.

Q. HOW DOES THE PROPOSED EFFLUENT DISCHARGE PRESENT A RISK OF HARM TO THIS AQUATIC LIFE?

A. Disturbances to this area—such as increased salinity, reduced oxygen levels, turbidity, noise, habitat alteration, and other stressors have the potential to reduce spawning activity and the reproductive output of these fishes. Given the disproportional number of fish that spawn in the inlet compared to adjacent areas and the fact that it is the only site for a large expanse of coastline that connects the Gulf to the bays, disturbances in this area could result in a direct measurable, negative impact on the size and productivity of the regional populations of these fishes. In turn, such a scenario would directly harm local fisheries by reducing the number of fish in the region that are available to be harvested, which would increase the risk of overfishing and collapsing these fish populations under current levels of fishing practices. Certain species and fisheries (e.g. southern flounder) have recently been identified as being in serious trouble and, thus, the protection of their spawning habitat is absolutely critical for recovery and sustainability.

Q. HAVE YOU DIRECTLY RESEARCHED THESE ISSUES?

A. Yes.

fish species. My main concern from a scientific, ecological, and even socioeconomic perspective is that the activities associated with the desalination discharge permit have not been demonstrated to be protective of this critical habitat, nor has the analysis done by the Port of Corpus Christi or the Texas Commission on Environmental Quality (TCEQ) even acknowledged and properly analyzed the plausible, negative impacts that desalination discharge can have on spawning and associated activities that are critical to sustain local fish populations and fisheries.

Q. WHY IS THIS SUCH A SIGNIFICANT CONCERN, IN YOUR OPINION?

A. Because the Aransas Ship Channel is the heart—the engine—of productivity for fishes and fisheries in the entire region. It is unique, essential fish habitat where all fish we care about spawn, feed, and migrate through (both adults and larvae). Degradation to this specific area will therefore cause cascading effects that impact (namely, reduce) the productivity of fish populations and fisheries in the surrounding region and bay systems. It is irreplaceable, because it is the only channel pass for huge stretches of coastline in both north and south directions. If this area is degraded, fish won't simply go elsewhere to spawn. They have evolved to spawn and migrate through this area (i.e. tidal inlets, channel passes) in synchrony with specific environmental conditions, so harming it will just cause them to spawn less (or not at all), reduce their feeding, and ultimately reduce the carrying capacity of local fish populations.

Q. How will desalination discharges under the permit impact spawning?

A. Given the sensitivity of spawning to very specific environmental conditions, the environmental changes from from effluent discharge can impact spawning in multiple ways. For example, female fish tend to stay along the bottom as they develop their eggs in preparation for spawning, and there is plausible evidence that the area along the

bottom will become hypersaline from the effluent discharge falling as it is released. This could disrupt egg development, egg production, and courtship and spawning activity. Also, the change in salinity in the water can disrupt the spawning migrations through the channel or cause spawning activity to become unsynchronized through false spawning cues created by pulses of high salinity.

Q. SO IS YOUR CONCERN SIMPLY THAT THE SPAWNING PATTERNS OF FISH WILL BE NEGATIVELY IMPACTED?

A. No, that is not my only concern.

Q. WHAT OTHER CONCERNS DO YOU HAVE?

A. As noted, the area is essential fish habitat. The proposed activities associated with the desalination permit do not protect this critical area or the ecological activity that occurs there. The effluent can lead to two concerning effects: (1) increased mortality of fish species, whether adult or larva, and (2) significant diminished reproduction of fish species. Combined, these two concerns present the potential to have a very destructive impact upon the local ecology. If you consider the cumulative effects of reduced spawning, which sets a reduced carrying capacity of fish that can be supported in the area, along with the perceived and predicted increases in mortality of larvae and juvenile fishes due to hypersalinity, the potential impacts could be quite severe. Essentially, you produce less eggs—possibly in the wrong locations or during wrong times due to disruptions by environmental changes—and then those fewer eggs and larvae produced die at a much higher rate than usual. Combined, this would result in fish populations being reduced significantly.

Q. YOU ALSO HAVE STATED THAT YOU BELIEVE THAT THE DRAFT PERMIT, IF ISSUED, WILL PRESENT A SIGNIFICANT THREAT TO COMMERCIAL FISHING AND FISHERIES IN CORPUS CHRISTI BAY AND THE SHIP CHANNEL. WHY DO YOU BELIEVE THIS?

A. I have developed the following opinions:

(1) I have concluded that the draft permit, if issued, will present a significant threat to the marine environment and aquatic life, particularly survival of the early life stages of fish and invertebrates. More specifically, the necessary analysis to ensure that the effluent discharges that would be allowed under the draft permit will not adversely impact the marine environment and aquatic life, , including fish and invertebrate growth and survival across a variety of life stages, has not been performed by the Port of Corpus Christi or the Staff of the Texas Commission on Environmental Quality (TCEQ). The salinity from the desalination effluent that would be allowed under the draft permit can have significant adverse impacts to aquatic life as discussed more fully in my testimony.

(2) I have concluded that the draft permit, if issued, will present a significant threat to commercial fishing and fisheries in Corpus Christi Bay and the ship channel. More specifically, the potential adverse impacts to aquatic life mentioned above, if realized, will result in significantly diminished fish populations in and around Corpus Christi Bay and the ship channel, which will adversely impact commercial fishing and fisheries in those same areas.

(3) I have concluded that the draft permit does not include all appropriate and necessary requirements to adequately protect aquatic life from adverse, and potentially disastrous, impacts from the discharge that would be allowed under the permit.

Q. HAVE YOU COMMUNICATED WITH OTHER TESTIFYING WITNESSES RETAINED BY PAC AND OFFERED AS EXPERTS IN THIS CASE REGARDING YOUR OPINIONS?

A. Yes.

Q. WHICH OTHER TESTIFYING WITNESSES RETAINED BY PAC AND OFFERED AS EXPERTS HAVE YOU COMMUNICATED WITH IN THIS CASE REGARDING YOUR OPINIONS?